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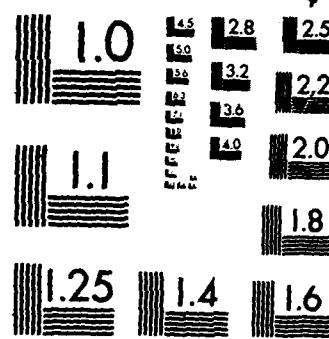
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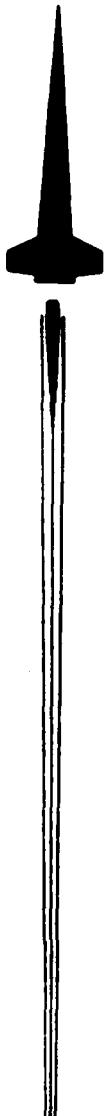
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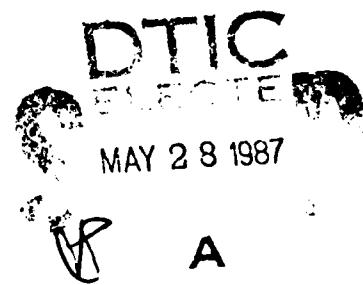
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TECHNICAL REPORT RD-DE-86-4

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PCYUGRAF2 PC BASED CODE FOR TEXT AND VISUAL AIDS

Miles E. Holloman  
William F. Otto  
Directed Energy Directorate  
Research, Development, and Engineering Center



AUGUST 1986



U.S. ARMY MISSILE COMMAND

Redstone Arsenal, Alabama 35898-5000

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## I. INTRODUCTION

The PCVUGRAF2 program is an improved version of the earlier PCVUGRAF program (MICOM Technical Report TR-RD-DE-86-1). The PCVUGRAF2 program is written in PASCAL; Turbo-Pascal, Borland International, and no longer requires the third party graphics library GRAPHMATIC. This language change provides a transportable code without the requirement placed on the user to supply any additional library routines. Additionally the code facilities have been enhanced to provide a better user interface and take advantage of the newer Hewlett-Packard plotters that provide automatic page feed.

## II. BACKGROUND

The PCVUGRAF2 program was developed within the MICOM Directed Energy Directorate as an expedient tool for the creation of presentation quality text charts. The philosophy that drove the code development was that the tool should be compatible with a minimal microcomputer system, not require excessive computer background or knowledge, allow for the storage of the chart information on disk, and provide sufficient options to allow a reasonable variety of chart types at a presentation quality level. Presentation quality level is defined as a graphic arts quality at least that of typewriter generated charts but not necessarily of the professional quality of a graphic arts department. The approach was to develop the code in TURBO-PASCAL on a microcomputer equipped with a Hewlett-Packard pen plotter. A number of Hewlett-Packard pen plotters are available; the model 7550A is used in this discussion as typical of these plotters, compatible with most microcomputers and having exploitable built-in features that would facilitate and simplify the program development.

Alternate approaches to the code development were considered but finally narrowed to two. One approach would be that of a design that would be very user friendly in which it would be assumed the user would have little or no knowledge of a computer. The code in this case would be required to "ask questions" of the user, process the information, store the data on file, and finally plot the resulting chart as the built in logic would dictate. From experience it was found that with experienced computer users, this approach of having to address multiple menus again and again is an undesirable burden and the preferred approach would be that of minimizing this interaction. Additionally, while it might appear desirable to have a feature to preview the chart on the monitor prior to the plotting, to incorporate this feature could require substantially more complicated coding as well as a hardware requirement to include a graphics monitor as a minimum. The selected approach resulted in a code design that assumed the user to have available a typical editor/word processor program to create a file of information to be processed by the PCVUGRAF2 program. The only preview of the final chart would then be in the editor/word processor display on the monitor screen. There is a distinct advantage to the elimination of the screen review in that the plotted chart is now in no way related to the ability to display the chart on the monitor screen. The chart is not limited by eighty character lines or in the case of graphics screens the somewhat coarse graphics of 640 x 200 or at best 640 x 350 resolution. Additionally the typical twenty-five lines per screen limit of most monitors is also avoided but at the sacrifice of not really knowing what the chart is like until it is plotted. Experience has shown the gains in

speed and versatility of this approach outweigh the ability to preview the chart before plotting. The selected approach allows for various sizes of the lettering but only the font that is built into the plotter being used. For this reason the newer Hewlett-Packard plotters are recommended in that the built-in fonts are more pleasing to the eye than the fonts in the older models.

Within the Directed Energy Directorate, the PCVUGRAF2 program has proven to be a very useful tool for generation of charts and vugraphs in a cost effective, expedient manner. The ability to store the chart in a disk file allows the chart to be corrected or modified easily and provides a convenient record for future reference.

### III. PCVUGRAF2 HARDWARE/SOFTWARE REQUIREMENTS

PCVUGRAF2 is written in TURBO-PASCAL to include the plotter interface as well as the plotting routines. Machine requirements are that of an IBM PC or IBM PC compatible microcomputer with a minimum of 128K of RAM, MICROSOFT DISK OPERATING SYSTEM (MS-DOS), a monochrome or graphics monitor and a Hewlett-Packard plotter (model 7550A is typical). A line printer is useful to allow viewing of the entire file but is not required. The code has not been checked on all Hewlett-Packard plotters but appears to operate properly on those tested. Additionally it is required that an editor/word processor is available. To take full advantage of the PCVUGRAF2 program this editor should not be limited to eight character lines but be capable of up to one hundred and sixty characters per line.

#### IV. PCVUGRAF2 FILE CREATION

To generate a chart using PCVUGRAF2, the user must first create a file with the proper instructions and information for the program to process. This information consists of lines of code containing two single character values the first of which indicates lettering size or special feature and the second indicating the pen or alternate special features to be used in the plotting of this current line of data followed by the text or special information/instruction for this line of data. The PCVUGRAF2 program assumes the final chart to have a format consisting of a TITLE section and a BODY section optionally contained within a frame. The TITLE section generally contains one to three lines of text and is automatically horizontally and vertically centered by the program. In this section of the chart the PCVUGRAF2 code adjusts the letter size to ensure that the intended information be contained within the allotted space. The BODY section of the chart may contain up to 110 lines of text. In this section, the code does not automatically horizontally center the text but allows the user complete control over the layout in this section. The code does, however, ensure the lettering size is adjusted so that all information fits within the bounds in length and height of this section. The code logic is such that the total number of lines of code in this section is determined as is the maximum number of letters in the longest line. From this information, the letter size is adjusted so that all information will fit within the bounds of this area accounting for the various sizes of letters. In both the TITLE and BODY sections of the chart leading blanks are counted as blank characters, however, the trailing blanks are not included in the total character count. The user will find that complete control in this section sacrifices the code logic that would automatically prevent unpleasant aspect ratios in the lettering. For example, if only one line of text is indicated in the BODY section of the chart the code will attempt to fill the entire BODY with this single line creating very tall lettering. To avoid this program, experience will indicate the inclusion of blank lines used as spacers or space-savers to adjust the height and width of the lettering. Figure 1 illustrates the general form of a PCVUGRAF2 chart and indicates the TITLE and BODY sections enclosed in two of the frame options provided in the program. The standard features of affixing the file name, current data, and organization are also illustrated in this figure.

##### A. Title Section

The TITLE section of a chart typically contains from one to three lines of text. The instructions for this section are of the form:

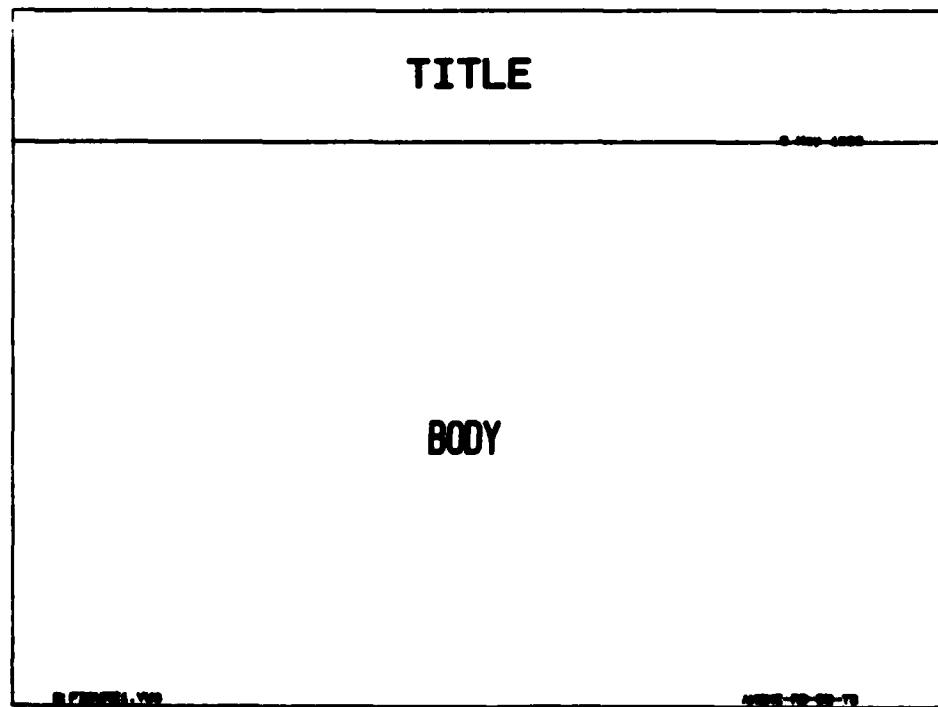
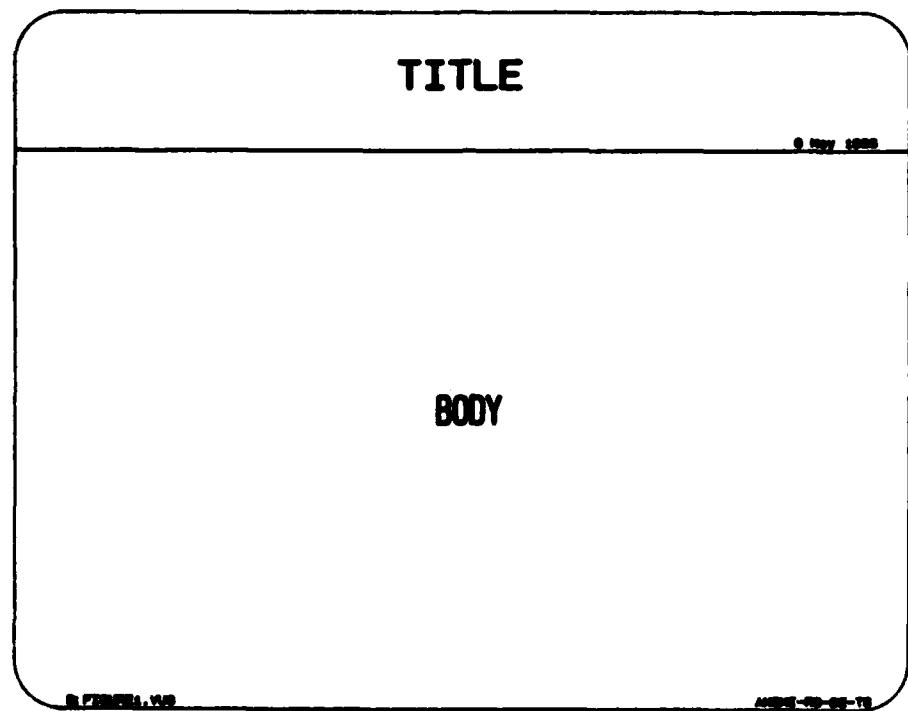
**SIZE,PEN,TEXT**

where **SIZE** is a single character representing the relative size of the line of code.

**PEN** is the pen number to be used in plotting the text.

**TEXT** is the string of characters to be plotted.

**Note:** The program requires the **SIZE** character code to be in column 1 of the card image field; **PEN** character code in column 3, and the **TEXT** section



**Figure 1. General format of TITLE and BODY of PCVUGRAF.**

beginning in column 5. Each of these sections is separated by a comma. The PCVUGRAF2 program will raise an error message if the format of the input is violated.

### 1. Size Options

Three options are available for the SIZE parameter to determine the relative size of the lettering in each line. The options are S, M, and L representing lettering in the relative size ratio of 0.64, 0.80, and 1.00. That is, if on one line large, L, lettering is used and the next small, S, is used, the size of the small lettering will be 0.64 of the large lettering size. These ratios are given as relative rather than absolute since the actual letter size will depend on the number of lines of text and the maximum number of letters in the longest line in this section. As previously stated, the code automatically centers each line of text in this section. This centering requires the counting of the characters per line and in so doing leading blanks are included in the total, trailing blanks are not. Thus, common practice is to begin the line of TITLE text in the first available position in the text field to assure proper centering.

### 2. Pen Options

The options for PEN are dictated by the plotter. The model 7550A, an eight pen plotter, will then have eight options 1,2,3,4,5,6,7, and 8; the actual pen colors or line widths will be dictated by the placement in the plotter carousel.

### 3. Text

TEXT represents the actual string of characters to be plotted and is limited to 160 characters. A practical limit is generally less than thirty characters to assure the lettering size to be in keeping with typical titles and the expected appearance of charts of this nature.

Experience has shown that three lines of text in this section is a practical limit from the appearance of the resulting chart. Additionally, even if only one line of text is desired it is suggested two blank lines be used to ensure a more pleasing appearance to the lettering. Figure 2 illustrates a typical one line title; the code to generate this figure as well as all figures to follow is contained in Appendix A, note the resulting aspect ratio in this section of the chart. From the code used in Figure 2, it should be noted that the string of dashes denotes the end of the TITLE section. Figure 2 should be compared with Figure 3 in which additional blank lines have been used to cosmetically improve the appearance of the TITLE section of the chart.

An additional feature of this section is that of handling of possible classifications placed on charts and vugraphs. It is common practice to require that restricted information be properly marked. The manner in which this is done is to mark the chart both top and bottom by information such as "FOR OFFICIAL USE ONLY". The PCVUGRAF2 code will automatically assume that if the first line of coded instruction in the TITLE section requires the small, S, letter size, the intent is that the TEXT will be a classification marking

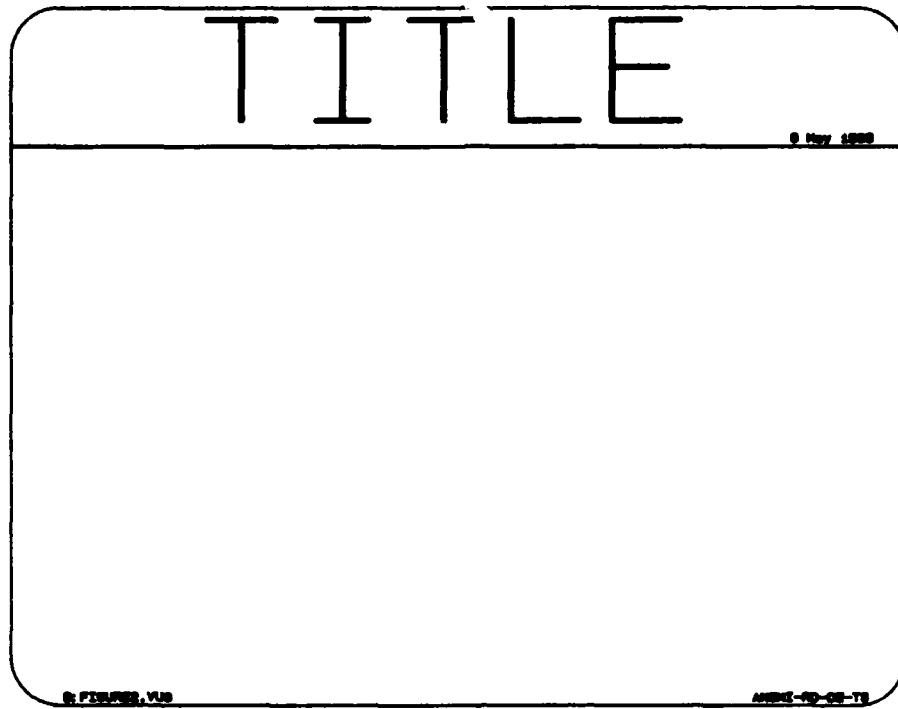


Figure 2. Typical chart (note oversized lettering).

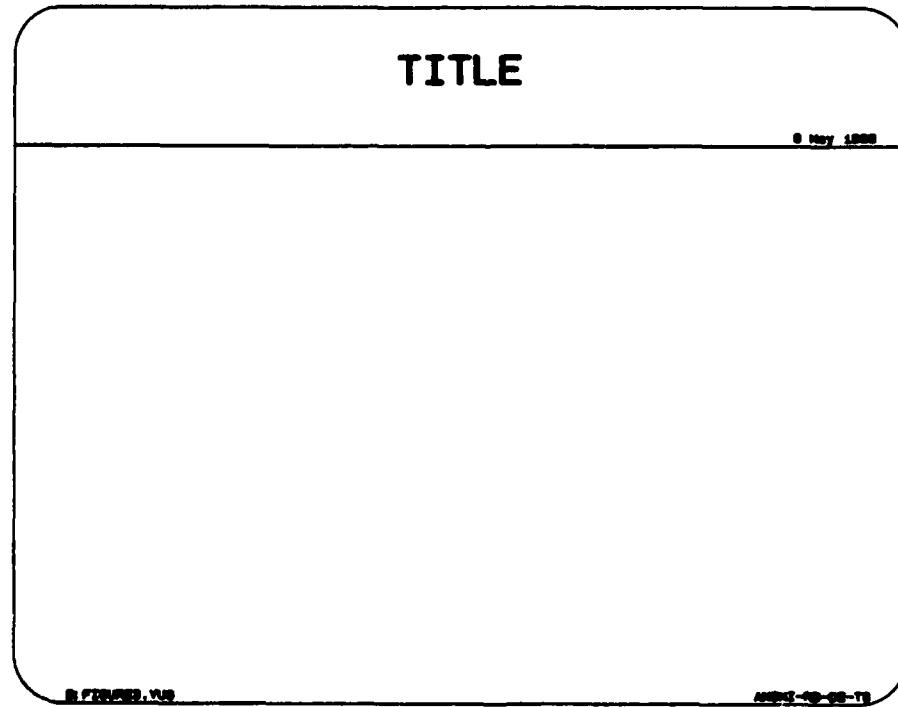


Figure 3. Additional blank lines used to cosmetically improve appearance of TITLE.

to be placed on the first and last lines of the chart. Figure 4 illustrates the code and resulting chart for this option. The final user option for the TITLE section is not specified in the generation of the data file but rather in the running of the PCVUGRAF2 code. This option, to be discussed in the "RUNNING THE PROGRAM" section determines the number of times the TITLE section is to be overwritten. Each time the TITLE is overwritten the pen is slightly offset to add width and boldness to the lettering thus enhancing the appearance.

## B. Body Section

In the data file containing the information to be processed by the PCVUGRAPH2 program the TITLE section is separated from the BODY section by a string of dashes. This delimiter will not appear in the final plotted chart but is used within the editor to allow the user to easily see the general form and layout of the chart. In this section of the chart, additional options are available to allow not only the three letter sizes but also special characters, overlaying, subscripts, superscripts, underlining and the drawing of combinations of horizontal and vertical lines to form enclosures for tables, schedules and highlights. As in the TITLE section the coded instructions are of the form:

### SIZE/OPTION,PEN/OPTION,TEXT/GRAFICS INSTRUCTION

#### 1. Size Option

The above form appears more complicated than that previously discussed for the TITLE section. The SIZE/OPTION is again a single character that specifies the letter size, S, M, or L but in addition has the options of T, B, O, and C to indicate additional modes of operation. The first character in each line of instruction code may be as before S, M, or L indicating the relative size of the desired lettering. The relative sizes are as before 0.64, 0.80, and 1.00 with the absolute letter size determined by the number of lines of text and the maximum number of letters in the longest line. For example, typical lines of code may have the form:

L,1,THIS IS A TYPICAL LINE OF LARGE LETTERING

S,2,THIS IS A TYPICAL LINE OF SMALL LETTERING

The SIZE character code, L and S in the above example must be located in column 1 of the card image; the PEN character code, 1 and 2 in the above example, must be located in column 3 of the card image, and the TEXT section can be located beginning in any column from 5 to 160. These sections of the instructions are separated by commas as in the TITLE section.

The PCVUGRAF2 program does not automatically center text in this section of the chart thus the relative positioning is up to the user. In the above example the "T" in "THIS" would be at the far left boundary of the chart and the final letter "G" in "LETTERING" would be at the far right boundary of the plotting area which might lead to undesirable aspect ratios. Figure 5 illustrates the chart resulting from this coded instruction set and the undesirable appearance. As the examples develop, it will become clearer how to

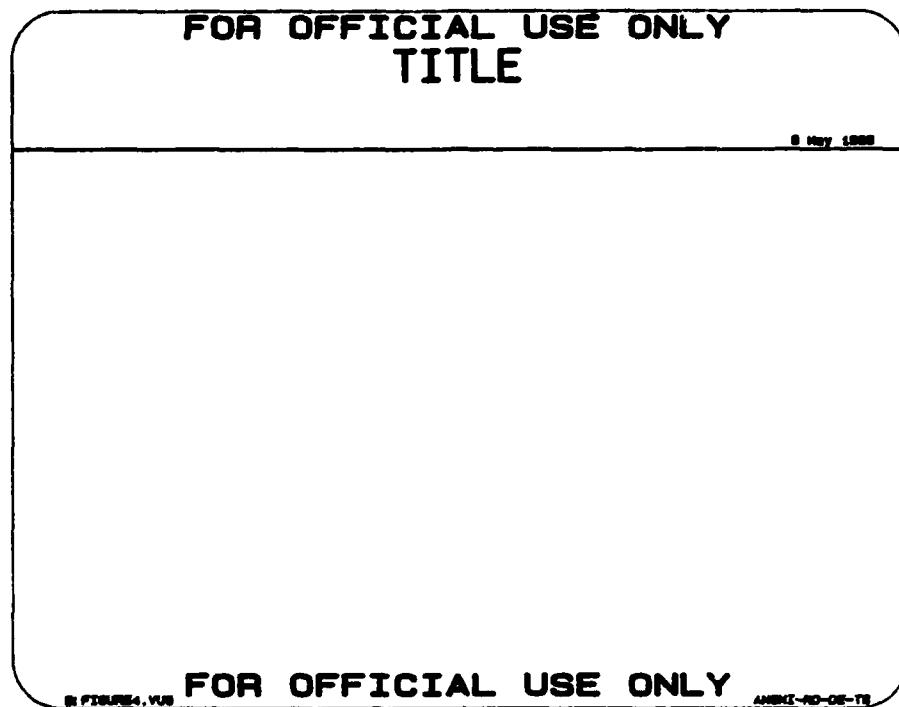


Figure 4. Classification marking in TITLE and BODY sections.

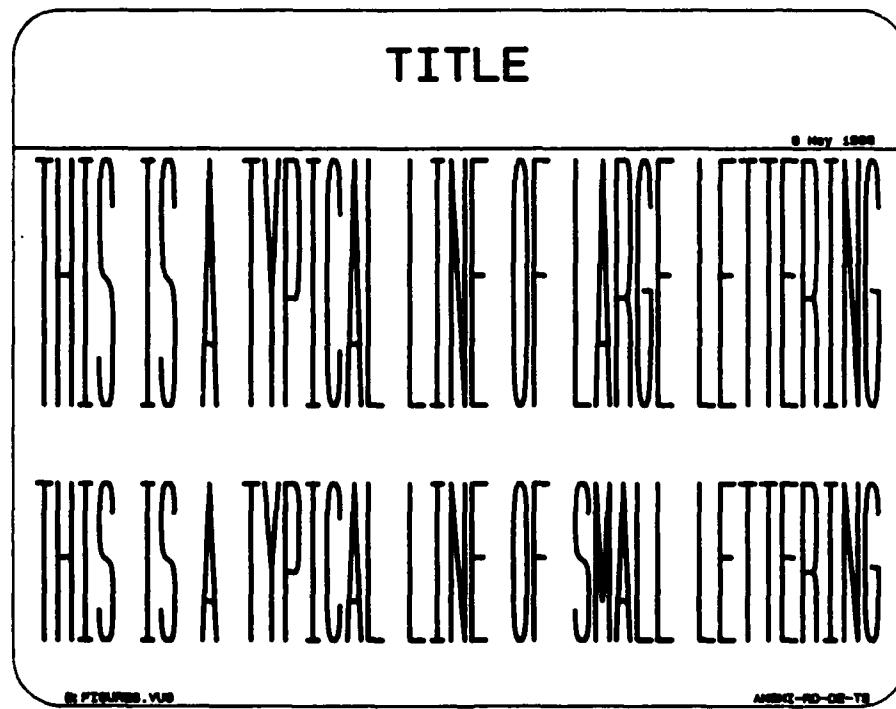


Figure 5. Undesirable appearance of chart.

avoid these problems but in general it has been found from experience that a minimum of approximately twelve lines are required in this section, many of which may be blank, to achieve a reasonable aspect ratio to the lettering. Figure 6 illustrates this improvement.

## 2. First Character Options

The additional first character options T, B, O, and C indicate special features that are applied relative to a line of code beginning with the more familiar S, M, or L. This is, a given line of text code plotted using the S, M, or L options, to be referred to as the base line in this discussion, can be modified or enhanced by the use of the T, B, O, or C options. The option T indicates superscript and the B indicates a subscript. Superscripts and subscripts are of a smaller lettering size, relative size ratio 0.50, and are located slightly above or below the base line of text. An example of their use is as follows in which leading spaces have been added within the text to better position within the available area.

T,5, 2

L,5, AREA = PI \* R

Notice that to exercise the superscript option or subscript option two instruction code lines are required. The "2" to be used as the superscript is located in the column immediately to the right of the "R" in the base line of CODE. The line of code:

L,5, AREA = PI \* R

is the base line of code in the example. This feature is illustrated in Figure 7.

## 3. Overlay Option

The O or overlay option is to allow the use of different pens to write lettering on a single line of text. This option might be used to highlight a word or phrase within a line by writing over a given word a second time to make it somewhat darker than the surrounding text or to use an alternate pen to insert a highlighted word or phrase within the line. The following example illustrates the code to insert a word written with an alternate pen within the base line of code; see Figure 8.

L,1,THE BASE LINE HAS A IN IT

0,5, HIGHLIGHT

It is assumed the pen number 5 is somehow different from pen number 1 such as being wider or of an alternate color. The overlay, O, option can be used with any letter size, S, M, or L and the overlaid text will be sized according to the base line of code directly above it in the above example. Multiple overlays are possible to provide the use of several different colors of pens on a single line as in the following example.

L,1,                   BLACK PEN #1  
0,2,                   RED PEN #2  
0,3,                   GREEN PEN #3

#### 4. Special Character Option

The special character or C option provides for characters and symbols not normally available within the built-in character set of the plotter. These characters are currently limited to mathematical and typical Greek symbols used in science and engineering. The manner in which the special character option is used is to so signify by the first letter of the instruction code beginning with "C" followed by the pen number to be used. The text section will be interpreted as special character code rather than the normally represented ASCII character. Table 1 lists the special character codes and the corresponding special character. For example, the letter "p" is used to indicate the desired use of the greek letter  $\pi$ . The special character option is used in a manner simular to the overlay option in that it is assumed by the program the special character is to be inserted or overlayed within a base line of code that preceeds it and thus determines the actual letter size. An example of the use of this option is:

T,1,                   2  
L,1,    AREA =        \* R  
C,1,                   p

Figure 9 illustrates the resulting chart from this set of instructional code. For those cases in which the special character is not to be inserted within a line of text but is to be a separate line of text, the approach would be to create a blank base line into which the special character would then be inserted.

#### 5. Pen Option

The Pen/Option character code not only provides the pen number to be used in plotting the text but also provides two additional options in this section. The underline option, U, provides a mechanism to under line a portion of a line of text. This option is used much like the modification and enhancement options previously discussed. An example of its use is:

L,5,                   THIS IS AN EXAMPLE OF THE UNDERLINE  
S,U,                   -----

where the character is used to indicate the underlining option, see Figure 10.

The graphics option provides the ability to draw limited graphics. These graphics are limited to horizontal and vertical lines between end points specified by the user. The coding used is to denote the use of this option by specification of "S,G," as the code. The TEXT section of the line

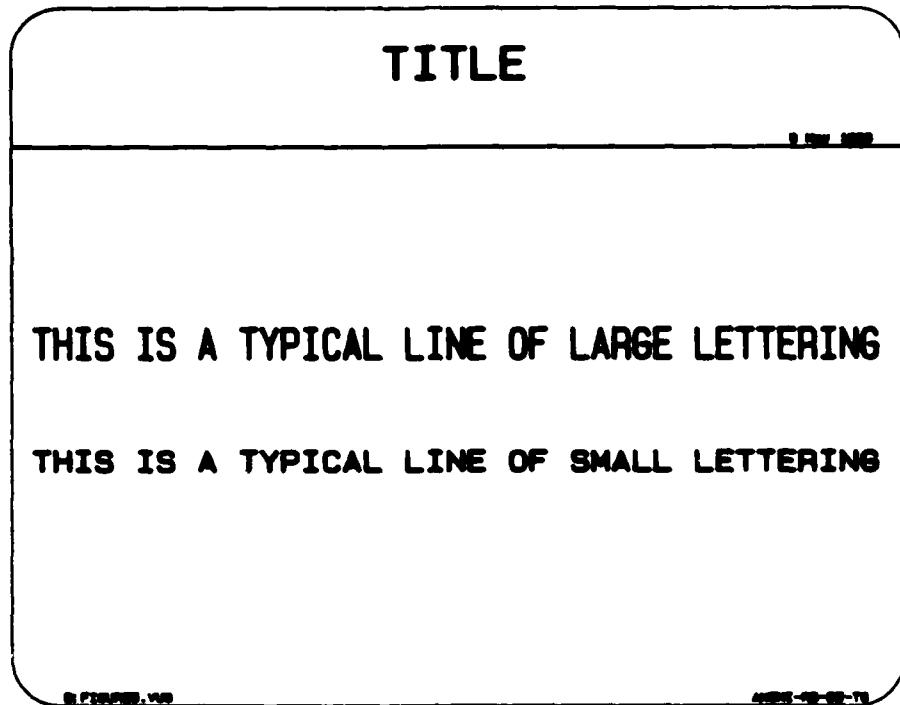


Figure 6. Reasonable aspect ratio in the lettering of the chart.

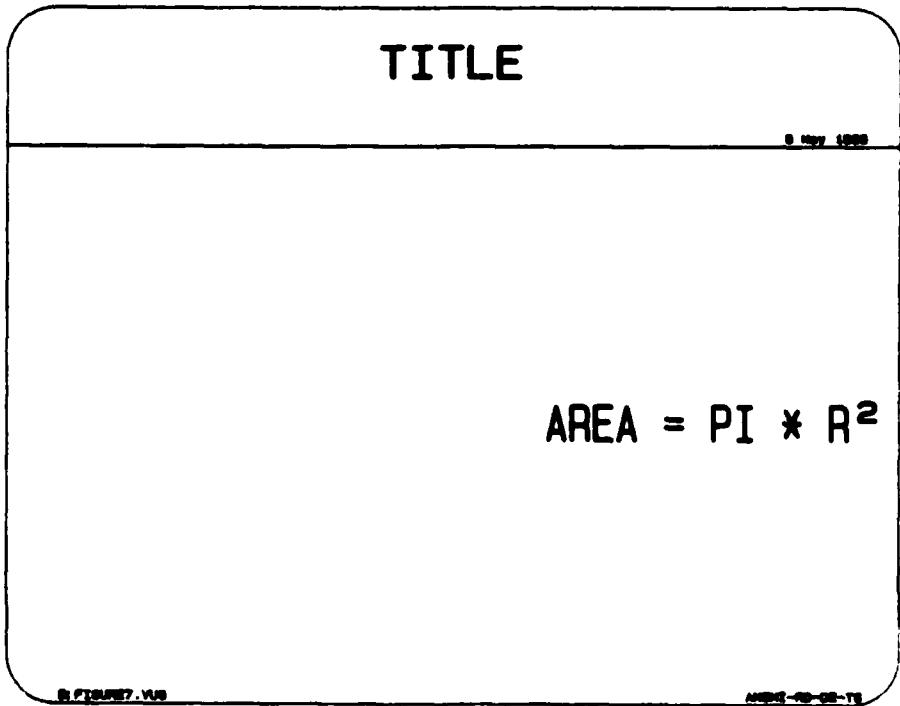
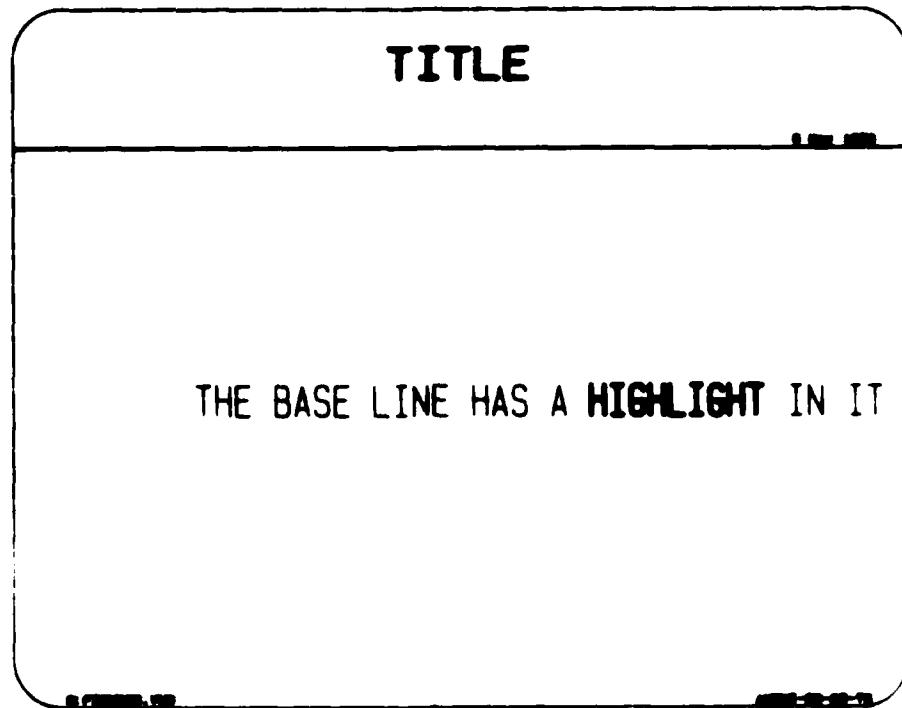


Figure 7. Superscript option.



**Figure 8. Overlay option.**

TABLE 1. Special Character Codes

SPECIAL CHARACTER CODES			
CODE	CHARACTER	CODE	CHARACTER
!@#\$%^&*()_+=-}{;:,.<>	!@#\$%^&*()_+=-}{;:,.<>	\$%&^*()_+=-}{;:,.<>	\$%&^*()_+=-}{;:,.<>

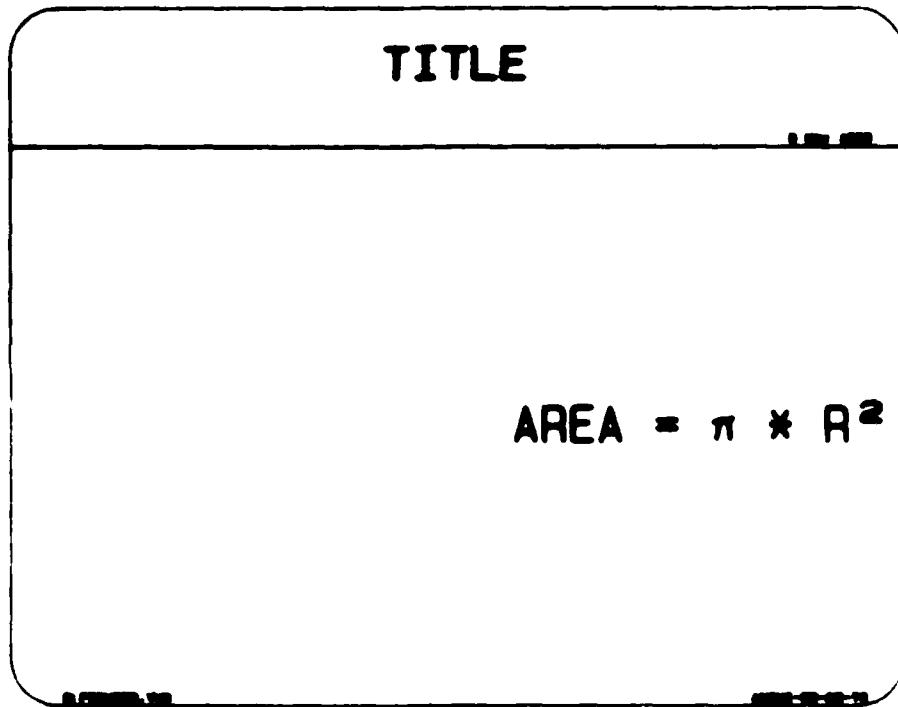


Figure 9. Special character option.

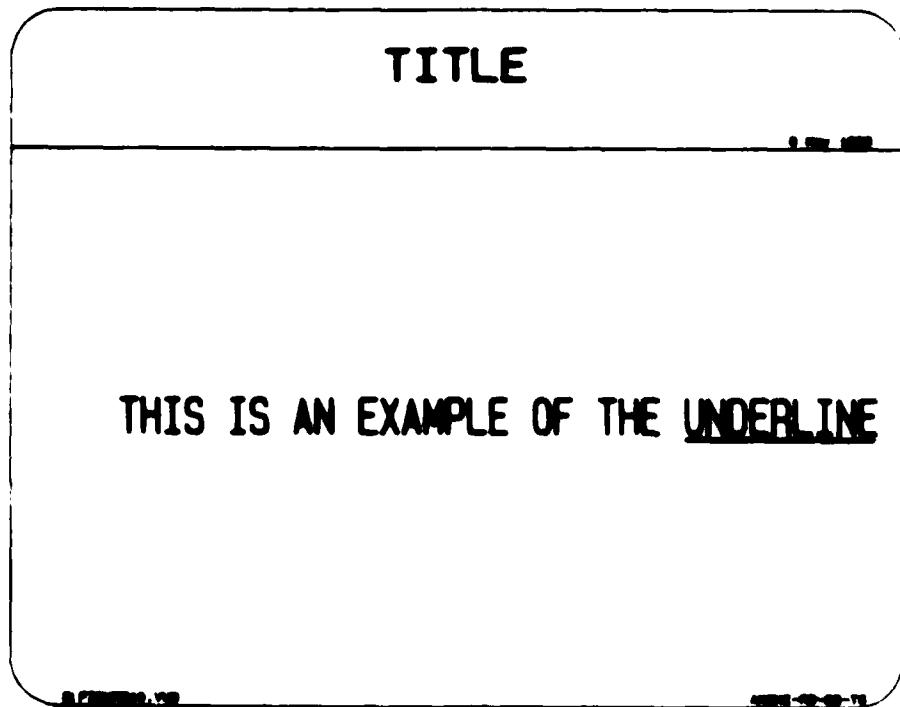


Figure 10. Underline feature.

of code is replaced by the single character letters T, B, L, R, and +. The character T denotes the upper extreme of a vertical line to be drawn between T and B where B denotes the lower extreme. Likewise L and R are the extremes, left and right, of a horizontal line. Placement of these lines within the normal text will allow the text to be separated by horizontal and vertical lines. An example of its use is as below:

S,G,L	T	T	R
L,I, TECHNICAL AREA	FUNDS AVAILABLE	COST TO DATE	
S,G,L			R
M,I, HARDWARE	\$10,000.	\$3,000.	
S,G,L	B	B	R
M,I, SOFTWARE	\$ 9,000.	\$5,000.	
S,G,L			

Figure 11 illustrates the resulting chart. The appearance of the chart would be improved if the text was enclosed within a box rather than only the horizontal and vertical lines. The "+" character is used to accomplish this. The "+" locates a corner and requires second graphics character, L, R or + to be located on the same horizontal line and another in the same vertical column to complete the definition of the corner. This is best seen by example; the previous example is repeated as follows:

S,G,+	T	T	+
L,I, TECHNICAL AREA	FUNDS AVAILABLE	COST TO DATE	
S,G,L			R
M,I, HARDWARE	\$10,000.	\$3,000.	
S,G,L	B	B	R
M,I, SOFTWARE	\$ 9,000.	\$5,000.	
S,G,+			+

Figure 12 illustrates the chart resulting from these instructions. The graphics option requires the use of pairs of symbols to define the beginning and terminating locations of horizontal and vertical lines. These symbols must be properly aligned in the instruction file and failure to do so will cause the program to accomodate the symbol as to providing adequate space to perform the graphics but will not actually draw the lines unless the pairing is accomplished. That is, the code matches only vertical and horizontal end points, if the end points do not align themselves properly it will be interpreted as single end points of different lines rather than end points of the same line. Since trailing blanks are not used to determine the maximum line length, no

TITLE		
TECHNICAL AREA	FUNDS AVAILABLE	COSTS TO DATE
HARDWARE	\$10,000	\$3,000
SOFTWARE	\$ 9,000	\$5,000

Figure 11. Vertical and horizontal line features.

TITLE		
TECHNICAL AREA	FUNDS AVAILABLE	COSTS TO DATE
HARDWARE	\$10,000	\$3,000
SOFTWARE	\$ 9,000	\$5,000

Figure 12. Box feature.

means has been discussed to this point to force the placement of short lines of text to the left portion of the chart. A convenient means of accomplishing this is to provide a final line of text using the graphics option with "R" in the column to define the right most boundary of the chart. To illustrate this, compare Figures 13 and 14 and the corresponding coding used to create them. An additional option is provided for drawing horizontal lines. This option is of the form:

L,1, -----

This command results in drawing a horizontal line between the extremes. If a single hyphen is used it is interpreted as a normal hyphen. Multiple hyphens are interpreted as a continuous line. This option thus makes the normal plotting of a string of hyphens impossible, however, this is provided as a special character feature. The instruction:

C,1,-----

will result in a hyphen string. The Appendixes contains examples of the use of these two features.

The preceding discussion has described the options available in the PCVUGRAPH2 program. The user can combine these features to construct charts and vugraphs of various types and forms. Typical examples of charts and vugraphs are found in both Appendixes of this report.

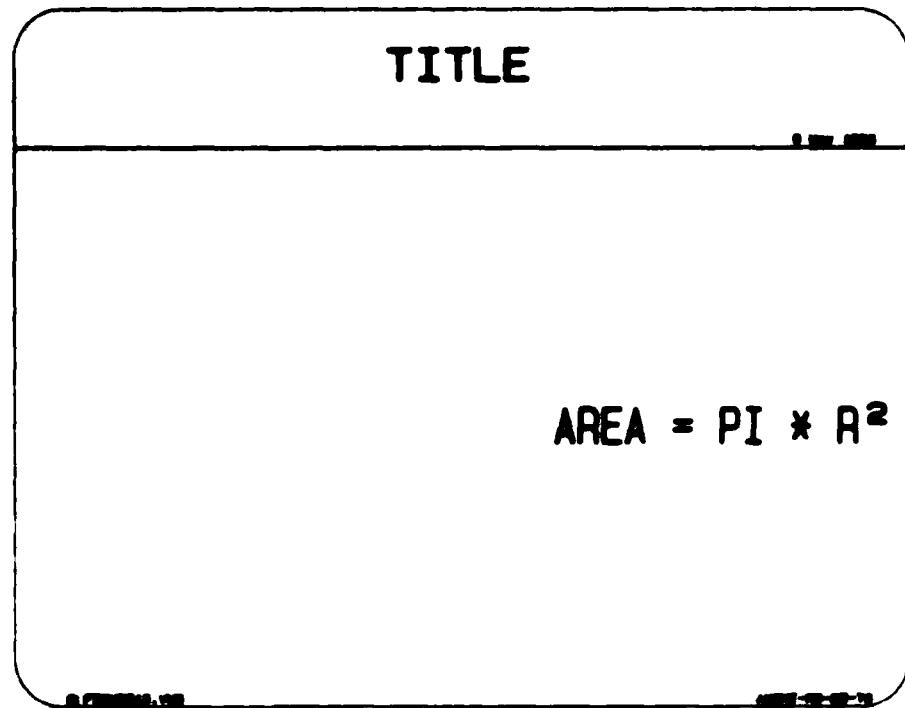


Figure 13. Placement of text in chart without graphic option to center text.

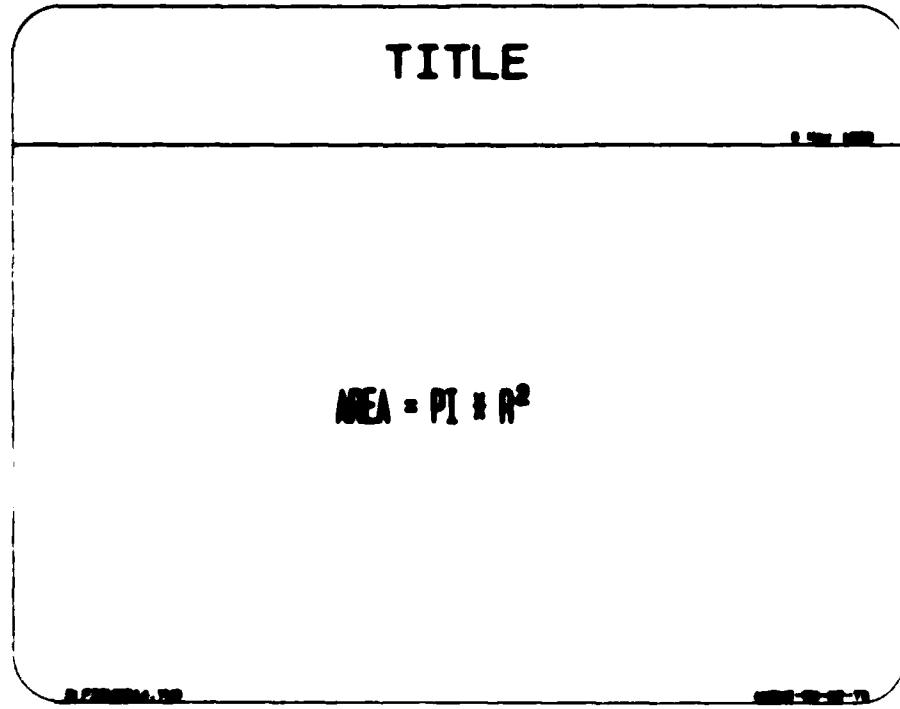


Figure 14. Graphic option to center text in chart.

## V. GENERATING A CHART/VUGRAPH

### A. Preparation

Paragraph B, "Running The Program", describes user input necessary for the code to generate a chart or vugraph. This input specifies the date, organization, disk drive containing the chart files, heaviness of the title section, frame style, chart size, and pen speed. A configuration file is provided to provide default values for each of these parameters so that rather than entering the values each time the code is run, the user can simply strike the enter key to use values contained in the configuration file. The configuration file is named VG.CFG and has the form:

COM1	{where is the plotter? com1 or com2}
2400	{baud rate: 300, 1200, 2400 etc. }
AMSMI-RD-DE-TS	{your organization }
B:*.VG	{where to look for files }
MEDIUM	{LIGHT, MEDIUM or HEAVY }
FRAME	{FRAME, CHART, BCHART or NONE }
1.0	{chart size: 0.5 to 1.0 }
10	{pen speed: 1 - 35 }

Most of these input parameters are self-evident. The third of the values in a character string that specifies the organization or other code specifying the origin of the chart. This input is limited to 15 characters. The input specified as "MEDIUM" determines the darkness of the title section of the chart. Four options are available to specify the type frame used in the final chart. FRAME specifies the rounded corner frame typical of vu-graphs. CHART is the box style typically 8 x 10 inches. BCHART is a larger box that requires larger paper 11 x 17 inches. The input with the value "1.0" is the size of the resulting chart with a value 1.0 specifying full size chart of sufficient size to occupy a typical 8 x 10 inch sheet of paper or if the BCHART option is used to fill an area of approximately 11 x 17 inches. To reduce the size of the final chart values less than 1.0 are used.

### B. Running the Program

The program is initiated by typing the program name, PCVUGRAF, immediately following the operating system prompt. The program then prompts the user for affirmation of the date:

system date is 1 Apr 1986

enter plotdate or cr

The indicated date, in this case 1 Apr 1986, will be affixed to each chart generated. If the user desires an alternate date, it should be entered at this point.

The second prompt is in the form:

organizational symbol is AMSMI-RD-DE-TS

enter change or cr

The indicated organizational symbol will be affixed to the resulting chart; the user has the opportunity to change the default value at this point.

The user is next prompted to specify or select the chart instruction files to be processed. These are the files previously generated containing the instructions and text associated with the chart to be generated. This prompt is in the form:

to select files for plotting

Enter the drive

enter the directory

enter the file template -- example

\*.vug

-->

The user should enter the disk drive, directory if appropriate and template as desired. As an example, if the files were contained on a disk located on drive B the user would enter:

B:

The program would then list all files contained on this disk for the user to select from. If the only files to be considered were known to end in ".vug", the user might enter

B:\*.vug

to only list files on the B drive ending in .vug.

Having specified the location of the files and any template, the code will list the indicated files in the form:

Move w/ arrows, select w/ (Return), done w/ "D", abort w/ "A"

FIGURE1.VUG	FIGURE12.VUG
FIGURE2.VUG	FIGURE13.VUG
FIGURE3.VUG	FIGURE14.VUG
DEMO1.VUG	SCHEDULE.VUG
FIGURE4.VUG	BULLET.VUG
V6TITLE.VUG	
DEMON.VUG	
LPCVUGRA.VUG	
FIGURES.VUG	
LRVUGRAF.VUG	
FIGURE6.VUG	
DEMO2.VUG	
FIGURE7.VUG	
TITLE.VUG	
FIGURE8.VUG	
TITLE1.VUG	
FIGURE9.VUG	
FIGURE10.VUG	
FIGURE11.VUG	

The next step is to indicate which files are to be processed by the PCVUGRAF2 program. This is accomplished by moving the cursor with the cursor keys or arrow keys either up or down until it lies next to the file desired. The file is then selected and marked as such by use of the ENTER or RETURN key. The screen will indicate this by placing an asterisk to the right of the selected file as illustrated below.

Move w/ arrows, select w/ (Return), done w/ "D", abort w/ "A"

FIGURE1.VUG	FIGURE12.VUG
FIGURE2.VUG	FIGURE13.VUG
FIGURE3.VUG	FIGURE14.VUG
DEMO1.VUG *	SCHEDULE.VUG
FIGURE4.VUG	BULLET.VUG
V6TITLE.VUG	
DEMON.VUG	
LPCVUGRA.VUG	
FIGURES.VUG*	
LRVUGRAF.VUG	
FIGURE6.VUG	
DEMO2.VUG	
FIGURE7.VUG	
TITLE.VUG	
FIGURE8.VUG	
TITLE1.VUG	
FIGURE9.VUG	
FIGURE10.VUG	
FIGURE11.VUG	

The user can specify as many as thirty files to process. If the plotter in use has the features of automatic page feed, the model 7550A for example, each of the selected charts will be processed automatically without operator intervention. If a plotter such as the model 7475A is used which does not have automatic page feed, the user will be prompted at the appropriate time to change paper. This does allow a que of files to be processed without rerunning the PCVUGRAF2 code for each chart.

Once all the charts to be processed are specified, the user so indicates by entering "d" or "D" for "done". It is not necessary to follow the "d" with an ENTER. If for any reason the wrong drive or directory was selected, it is not necessary to "quit" and restart; simply indicate "done" and the next menu will allow the user to make the proper choices by repeating the above menu.

The next prompt confirming the selection of files is in the form:

enter Q to quit, R to reselect, return to plot

If the files have been appropriately selected, then indicate so by the ENTER or RETURN key.

The code will proceed to process all files previously selected. The code will display on the screen three windows that will remain for the duration of the processing. The second and third of the windows are dynamic and will monitor the progress of the program. The middle box contains the data file currently being processed, the specified options which will be discussed in the following section, and a dynamic indicator of the processing through the contents of both the plotter instruction buffer and a code buffer. This report will not discuss the details of these buffers but will indicate the buffers are used to interface the code with the plotter hardware. The code monitors the contents of both buffers and reports its findings in the form:

0133 >>>>>>>>>>>>>>>>>>>>

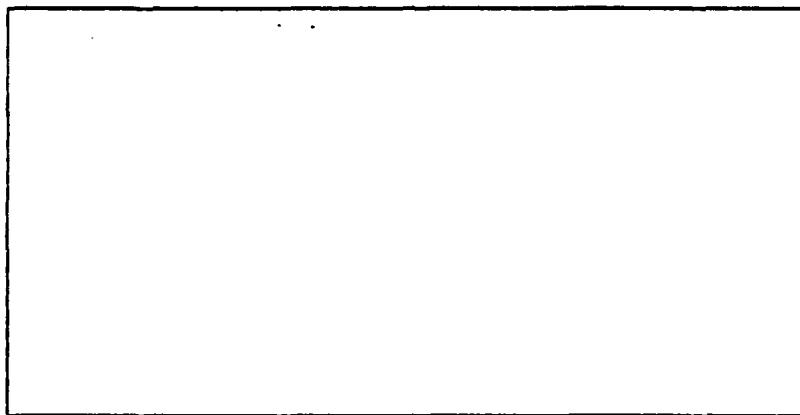
795 <<<<<<<<<<<<<<<<

The first line indicates the available space in the plotter buffer both numerically in bytes, 133 in the above example, and graphically as the length of the string of ">" or "<". The length of the string indicates the "fullness" of the buffer. The final or lower window displays the lines of code as they are processed and indicate any errors that may occur.

To complete the specification of the final chart, the user must specify four additional parameter values, the number of times the title is to be overwritten, the border style or frame to be used, the relative size of the chart, and the pen speed used in the plotting. The user will be prompted in the form:

PC - V I E W - G R A P H  
by Miles Holloman and William Otto

prog	filename	line	style	size	speed
V6	vi.id	B:DEMO1.VUG			
			10:29	7 May 1986	
			1024		



with the cursor located under the heading "line". "Line" indicates the number of times the TITLE section is overwritten. Three options are available:

LI - Light - only written once

ME - Medium - written twice

HE - Heavy - written four times

The default for this option is contained in the VG.CFG file and may be selected by striking the ENTER key. If any one of the other options is desired, it is selected at this time.

The user having selected the "line" option, the cursor moves to the "style" heading for selection of the style frame to be used. Three options are available;

FRAME - Vu-graph frame indicated in Figure 1

CHART - Box style frame indicated in Figure 1

BCHART - Large box style

NONE - No frame

The default value is contained in the VG.CFG file.

The size option may take any positive value with a maximum value of 1.0. Generally values are in the range 0.4 - 1.0. Again the default value is contained in the VG.CFG file.

The final option is for the pen speed. It has been found that in general a pen speed of 10 cm/sec is adequate for inking of the paper for most charts. Faster pen speeds provide the finished charts quicker at a possible sacrifice in inking, slower speeds may be required for proper inking of transparency materials.

Once these three options are specified, the program processes the charts in order. The middle and lower windows will monitor the progress of the program by indicating the file name of the chart being processed number of lines of code length of the longest line and the buffer status in the middle window. The lower window will monitor the lines of code being processed by displaying the line number and the actual line of code. The following example is typical of the screen display during processing.

PC - V I E W - G R A P H  
by Miles Holloman and William Otto

prog	filename	line	style	size	speed
V6	v1.id	B:DEMO1.VUG	MEDIUM	FRAME	1.0 10
67 lines	72 length			10:31	7 May 1986
0153	)	)	)	)	)
0					

1 S,2,CLASS  
1 S,2,CLASS  
2 L,1,——  
3 L,1,DEMO  
4 S,U,——

The program terminates and returns to the operating system at the completion of the processing of all files. The screen appears as below at program termination.

PC - V I E W - G R A P H  
by Miles Holloman and William Otto

prog	filename	line	style	size	speed
VG v1.1d	B:DEMO1.VUG	MEDIUM	FRAME	1.0	10
67 lines	72 length			10:35	7 May 1986
1024					
0					

66 C,1, 9  
67 B,1, 1

ELAPSED TIME = 3 min 56 sec

TOTAL ELAPSED TIME = 4 min 5 sec

H A V E A G O O D D A Y

C:\PCVUGRAF>

**APPENDIX A**

**Codes To Generate  
Figures 2 Through 14**

## APPENDIX A

This appendix contains the code used to generate Figures 2 - 14.

**Figure 2 -**

L,5,TITLE

-----

**Figure 3 -**

L,5,

L,5,TITLE

L,5,

-----

**Figure 4 -**

S,5,FOR OFFICIAL USE ONLY

L,5,TITLE

L,5,

-----

**Figure 5 -**

S,5,

L,5,TITLE

L,5,

-----

L,5,THIS IS A TYPICAL LINE OF LARGE LETTERING

S,5,THIS IS A TYPICAL LINE OF SMALL LETTERING

**Figure 6 -**

S,5,

L,5,TITLE

L,5,

-----  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,THIS IS A TYPICAL LINE OF LARGE LETTERING  
L,5,  
L,5,  
S,5,THIS IS A TYPICAL LINE OF SMALL LETTERING  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,

Figure 7 -

S,5,  
L,5,TITLE  
L,5,

-----  
L,5,  
L,5,  
L,5,  
L,5,

L,5,  
T,5,  
L,5,  
L,5,  
L,5,

2

AREA = PI \* R

L,5,

L,5,

**Figure 8 -**

S,5,

L,5,TITLE

L,5,

-----

L,1,

L,1,

L,1,

L,1,

L,1,

L,1, THE BASE LINE HAS A IN IT

0,5, HIGHLIGHT

L,1,

L,1,

L,1,

L,1,

L,1,

**Figure 9 -**

S,5,

L,5,TITLE

L,5,

-----

L,5,

L,5,

L,5,

L,5,  
L,5,  
T,5, 2  
L,5, AREA = \* R  
C,5, P  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,

Figure 10 -

S,5,  
L,5,TITLE  
L,5,  
-----  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,  
L,5, THIS IS AN EXAMPLE OF THE UNDERLINE  
S,U, -----  
L,5,  
L,5,  
L,5,  
L,5,  
L,5,

Figure 11 -

S,5,

L,5,TITLE

L,5,

-----

L,5,

L,5,

S,G,L

T

T

R

L,5, TECHNICAL AREA FUND'S AVAILABLE COST TO DATE

S,G,L

R

L,5,

L,5, HARDWARE \$10,000 \$3,000

L,5,

L,5,

S,G,L

R

L,5,

L,5, SOFTWARE \$ 9,000 \$5,000

L,5,

S,G,L

B

B

R

L,5,

L,5,

L,5,

Figure 12 -

S,5,

L,5,TITLE

L,5,

-----

L,5,

L,5,

S,G,+  
L,S,  
S,G,L  
L,S,  
L,S,  
L,S,  
L,S,  
S,G,L  
L,S,  
L,S,  
L,S,  
S,G,+  
L,S,  
L,S,  
-----  
L,S,  
L,S,  
S,G,+ T T +  
L,S, TECHNICAL AREA FUNDS AVAILABLE COSTS TO DATE  
S,G,L R  
L,S,  
L,S, HARDWARE \$10,000 \$3,000 R  
S,G,L  
L,S,  
L,S, SOFTWARE \$ 9,000 \$5,000  
L,S,  
S,G,+ B B +



L,5,

L,5,

T,5, 2

L,5, AREA = PI \* R

L,5,

L,5,

L,5,

L,5,

S,G,

APPENDIX B  
*Example Charts*

## APPENDIX B

Three example charts and their respective instruction files are contained in this appendix to serve as templets and guides to the more used chart forms.

Figure B-1 illustrates a typical "Bullet Chart" in which the special character bullet is used to highlight portions of a chart.

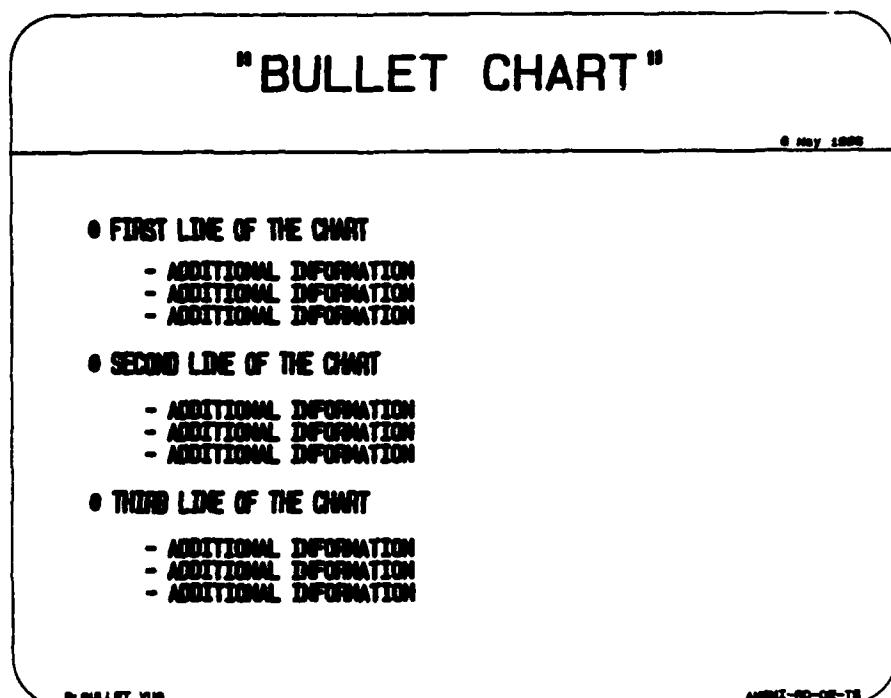


Figure B-1. Bullet chart.

### BULLET CHART CODE

S,5,

L,5,"BULLET CHART"

M,5,

-----

L,5,

L,5,

L,5, FIRST LINE OF THE CHART

C,5, @

S,5,

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5,

L,5, SECOND LINE OF THE CHART

C,5, @

M,5,

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5,

L,5, THIRD LINE OF THE CHART

C,5, @

M,5,

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5, - ADDITIONAL INFORMATION

M,5,

S,G,

R

Figure B-2 is a typical schedule chart combining the features of lettering, special characters and graphics.

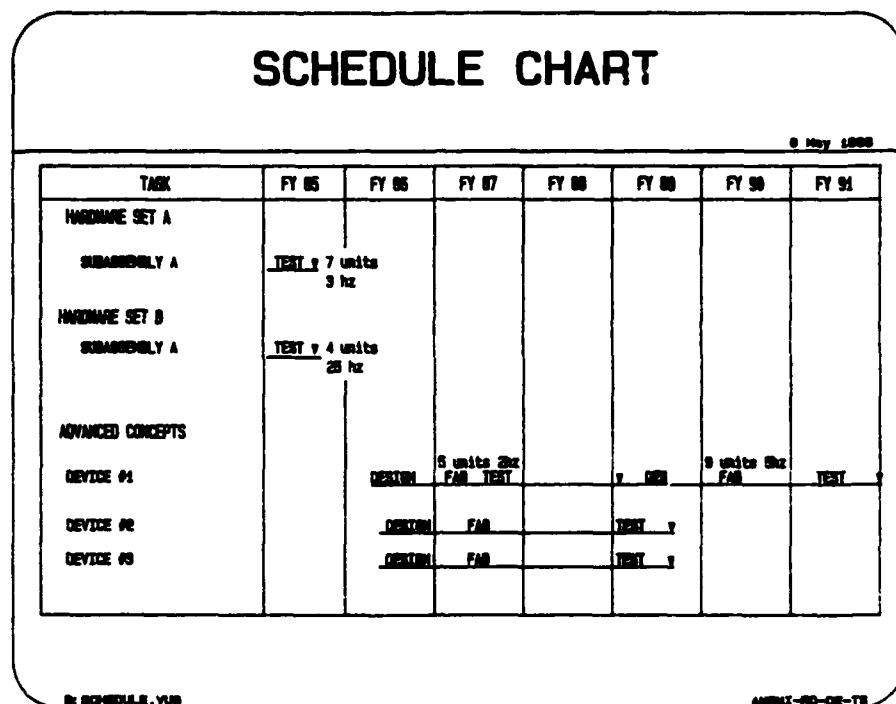


Figure B-2. Schedule chart.

**SCHEDULE CHART CODE**

S, S,  
L, S, SCHEDULE CHART  
L, S,

C,1,  
S,4,  
S,1,  
S,6,  
S,1,  
N,1,  
N,1,  
S,1,

25 hz

T

**ADVANCED CONCEPTS**

S,1,  
S,1,  
S,1,  
0,1,  
C,1,  
S,4,  
S,1,  
S,1,  
S,1,  
S,1,  
C,1,  
S,4,  
S,1,  
S,1,  
S,1,  
S,1,  
C,1,  
S,4,  
S,1,  
S,1,  
S,1,  
S,1,  
C,1,  
S,4,  
N,1,  
N,1,  
S,6,+  
L,1,

**DEVICE #1**  
**DEVICE #1**

	5 units 2hz			9 units 5hz		
	DESIGN	FAB	TEST	DES	FAB	TEST
				\$		\$

**DEVICE #2**

	DESIGN	FAB	TEST

**DEVICE #3**

	DESIGN	FAB	TEST

B B B B B B B B +

Figure B-3 is a demonstration chart in which most of the options available in PCVUGRAF2 are exercised for reference.

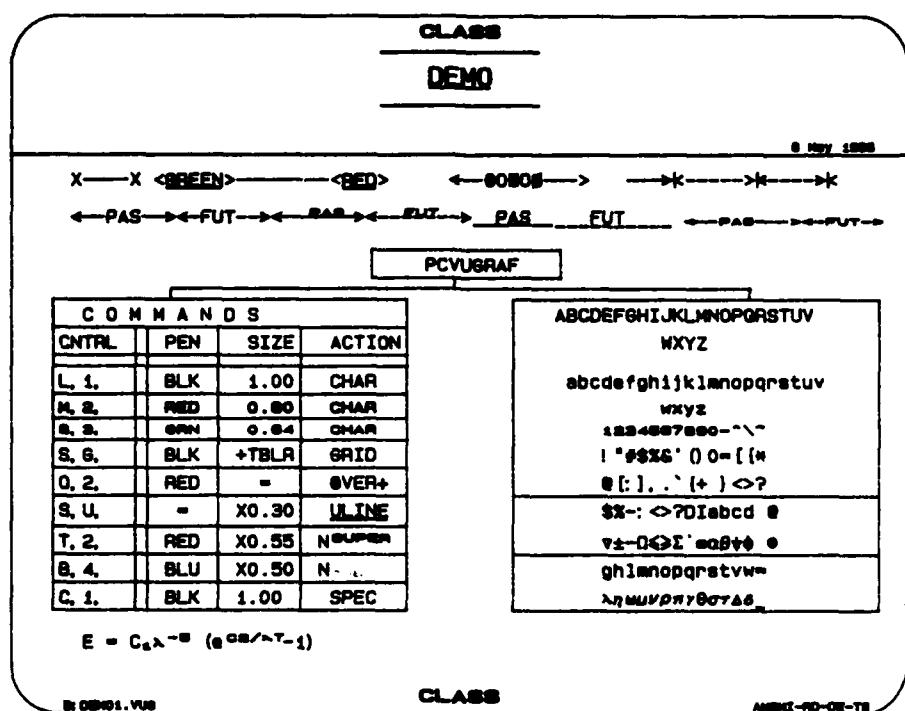


Figure B-3. Demonstration chart.

## DEMONSTRATION CHART CODE

S, 2, CLASS  
L, I, \_\_\_\_\_  
L, I, DEMO  
S, U, \_\_\_\_\_  
L, I, \_\_\_\_\_  
S, I, \_\_\_\_\_  
L, I, \_\_\_\_\_  
L, I, X—X ( )—( ) —00000— —| —| —|  
0, I, ( + X / ) ) ( ) ( ) ( )  
C, I, \_\_\_\_\_  
Q, 3, GREEN  
S, U, \_\_\_\_\_  
0, 2, RED  
S, U, \_\_\_\_\_  
L, I, \_\_\_\_\_  
T, I, PAS FUT \_\_\_\_\_  
L, I, PAS FUT

Q,1, ( ) ( ) ( ) ( )  
 C,1,  
 C,1,  
 S,U,  
 B,1,  
 Q,1,  
 C,1,  
 L,1,  
 S,G,  
 L,1,  
 S,G,  
 S,G,  
 S,G,  
 S,G, + B  
 L,1, COMMANDS  
 S,G, L TT T T R  
 L,1, CNTRL PEN SIZE ACTION MXYZ  
 S,G, L R  
 S,G, L R  
 L,1, L,1, BLK 1.00 CHAR abcdefghijklmnopqrstuvwxyz  
 S,G, L R  
 M,2, M,2, RED 0.00 CHAR wxyz  
 S,G, L R  
 S,3, S,3, GRN 0.64 CHAR 1234567890~!~  
 S,G, L R  
 L,1, S,G, BLK +TBLR GRID !"#\$%&()@=[{(\*  
 S,G, L R  
 L,1, 0,2, RED = OVER @[:],.'(+ )()?  
 0,2, + +  
 S,G, L R L R  
 L,1, S,U, = X0.30 ULINE \$x-:()?Diabcd @  
 0,2, —  
 S,U,  
 S,G, L R  
 T,2, SUPER  
 L,1, T,2, RED X0.55 N \$x-:()?Diabcd @  
 C,1,  
 S,G, L R L R  
 L,1, B,4, BLU X0.50 N ghijklmnopqrstuvwxyz  
 B,4, SUB R  
 S,G, L R  
 L,1, C,1, BLK 1.00 SPEC ghijklmnopqrstuvwxyz  
 C,1,  
 S,G, + BB B B + + +  
 L,1,  
 T,1, -5 C2/ T  
 C,1, 9  
 L,1, E = C (e -1)  
 C,1, 9  
 B,1, 1

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END

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